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SEVEN NEW SPECIES OF *HYDROTREPHES* CHINA (HELOTREPHIDAE: HETEROPTERA) FROM SULAWESI

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A definite locality in Sulawesi is established for *Hydrotrephes bouvieri* (Kirkaldy). The following new species are described; *Hydrotrephes celebensis* Polhemus sp. n., *H. kamarora* Polhemus sp. n., *H. marana* Polhemus sp. n., *H. nieseri* Polhemus sp. n., *H. taweli* Polhemus sp. n., *H. variegatus* Polhemus sp. n., and *H. viriosus* Polhemus sp. n. Some morphological features of Helotrephidae are discussed.

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Key words. – Indonesia; Sulawesi; Helotrephidae; *Hydrotrephes*; new species.

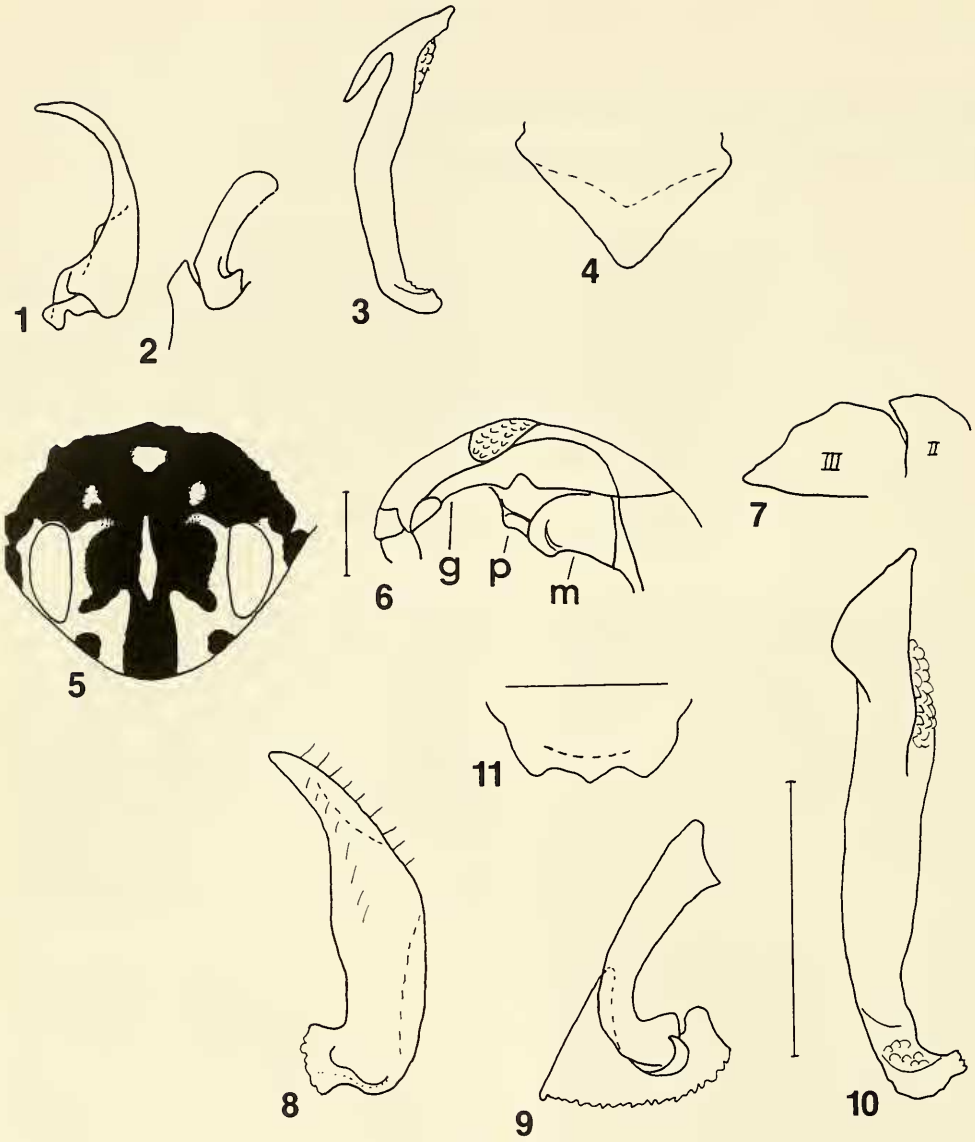
The following descriptions of new taxa and notes on *Hydrotrephes bouvieri* (Kirkaldy) are needed for a forthcoming publication on the Nepomorpha of Sulawesi by Nieser and Chen. These descriptions have been prepared for some time, intended to be part of a comprehensive revision of the genus *Hydrotrephes*, however the above intended publication by Nieser and Chen and a revision of the Helotrephidae of the Philippines intended by Herbert Zettel have persuaded me to instead deal with the genus on a regional basis. The material described here was mostly collected by D. A. Polhemus and myself during a 1985 expedition to the Malay Archipelago and Southeast Asia supported by the National Geographic Society. We have collected many species (mostly undescribed) of *Hydrotrephes* on Leyte, Luzon, Mindanao, Mindoro, and Palawan in the Philippines; Bali, Java, Sulawesi, north and south Sumatra, Sumba, and Timor in Indonesia; East Malaysia (Sabah) and West Malaysia. Additional species of the genus were collected by M. Satô on Bohol and Cebu in the Philippines, and by Taylor and Messer on Moratai, North Moluccas. Zettel (in litt.) possesses other species from Thailand, Laos, East Malaysia (Sarawak), and Indonesia (Nias). Thus the genus *Hydrotrephes*, with only six previously described species from Luzon, Sri Lanka, Sulawesi and Sumatra (all represented in the J. T. Polhemus Collection), is actually speciose and widespread; the general distribution, by region, was given by Polhemus & Polhemus (1990), along with a pattern of endemism exhibited by *Rhagovelia* (Veliidae) and *Ptilomera* (Gerridae) that is similar to some *Hydrotrephes* species on Sulawesi.

The last systematic reviews of the major classification of Helotrephidae were given by Esaki and China (1927, 1928) and China (1935), however Papácek, Stys and Tonner (1988) have provided an extensive review and morphological analysis in connection with the description of a new subfamily. The genus *Hydrotrephes* (type species, *Helotrephes bouvieri* Kirkaldy) was established by China (1935), after previously being carefully described by Esaki and China (1928, as *Helotrephes*) based on syntypes of *bouvieri*. Various authors have dealt with other genera of Helotrephidae and described new subfamilies, tribes, genera and species, but no new species of *Hydrotrephes* have been described for 66 years.

All measurements are given in millimeters. The holotypes and some paratypes will be placed in the Smithsonian Institution (USNM); all other specimens are in the Polhemus collection (JTPC), except some duplicate material that will be distributed to at least the Nieser Collection (NCTN), American Museum of Natural History (AMNH), Naturhistorisches Museum Wien (NHMW) and the Museum Zoologicum Bogoriense (MBBJ).

Species discrimination

A number of characters were evaluated as potentially useful in discriminating species of the genus *Hydrotrephes*, some previously used by other authors. The morphological nomenclature follows Esaki and China (1928) and Papácek, Stys and Tonner (1988) unless otherwise noted. I have concluded that that species discrimination should primarily rely on the morphology of the male genitalia, and to a lesser degree



Figs. 1-4. *Hydrotrephes bouvieri* Kirkaldy. – 1, Male ventral paramere; 2, Male dorsal paramere; 3, Aedeagus; 4, Female abdominal sternite VII. Internal phragma indicated by dashed line.

Figs. 5-11. *Hydrotrephes celebensis* sp. n. – 5, Cephalonotum, anterior view; 6, Pronotal and genal plates, meso- and proepisterna. g - pronotal and genal plates, m - mesoepisternum, p - proepisternum; 7. Ventral abdominal carinae II, III; 8, Male ventral paramere; 9, Male dorsal paramere; 10, Aedeagus; 11, Female abdominal sternite VII. All scale bars = 0.5 mm.

the female abdominal sternite VII and pattern of dark markings on the cephalonotum; all other characters are variable and must be used in conjunction with the former, with caution. For this reason a key has not been provided, but figures are presented instead to aid in the separation of species.

Lateral pronotal and genal plates: These structures are well developed in all Helotrephini (Esaki & China 1928, fig. 1a) but lacking in all Limnotrephini. The shape, particularly of the distinct 'notch' below the eye, is variable, and although sometimes helpful, should usually not be considered as diagnostic by itself.

Overall body size: The overall size is useful in separating species, and seems remarkably constant for individual populations of each species, except for the specimens of the sympatric variety of *H. nieseri* from northern Sulawesi which are much smaller than the nominate form (see discussion below). The macropterous form (with a claval suture) is usually darker and dorsoventrally larger than the brachypterous form (without a claval suture; hemelytra brachypterous, hindwings micropterous), and these two morphs may appear to be different species at first glance.

Male terminalia and genitalia: The morphological details of the complex terminal abdominal segments and genitalia of *Hydrotrephes* males are the most reliable characters for species separation. This includes the ventral laterotergites of segments VII and VIII, the posterior margin of abdominal segment IX, the parameres, and the aedeagus.

Mesopleural and propleural plates: The shapes of these plates are sometimes useful in discriminating between closely related sympatric species.

Ventral abdominal carinae: This character was used by Esaki and China (1927, 1928) and China (1935), but has proved to be variable and generally unreliable except for gross features. A few species have extreme modifications which can be diagnostic.

Prosternal carina: The prosternal carina is variable, but sometimes helpful when extreme differences are evident between species.

Female abdominal sternite VII. This structure, often called the subgenital plate, is sometimes diagnostic and often helpful, but the differences between species are often subtle, and closely related species may exhibit a similar shape.

Color pattern: The pattern of dark markings on the cephalonotum, in particular on the frons, are helpful in discriminating between closely related species. While the pattern may vary considerably in a given population, it varies in a predictable way, with certain 'markers' constant (analogous to the widely used hemelytral 'eunomy' in the family Saldidae). The maculations of the hemelytra are also sometimes useful in separating sympatric species.

Stridulatory mechanisms: All species of the genus *Hydrotrephes* possess a stridulatory mechanism, as described by Polhemus (1990). These appear to be monotonous and not species diagnostic. It is conceivable that an examination by SEM would reveal diagnostic fine structure not visible at 80 ×.

Hydrotrephes bouvieri (Kirkaldy)
(figs. 1-4)

Helotrephes bouvieri Kirkaldy 1904: 129. Syntypes 4 males, 2 of unknown sex, Celebes, de la Savinière, National Museum of Natural History, Paris [not examined]; Esaki and China 1927: 281; Esaki and China 1928: 143 (redescription, figures); Lundblad 1933: 114.

Hydrotrephes bouvieri – China 1935: 594 (new genus, key); Miyamoto 1952: 2; Poisson 1960: 333; Polhemus 1990: 60 (world checklist).

Material examined. – 46 brachypterous adults, 3 nymphs, Sulawesi Utara, Kab. Bolaang Mongondow, Lake Mala (Moat), E of Kotamobagu, 0°44' N, 124°27' E, 1000 m el., CL 2113, 10 Sept. 1985, J. T. & D. A. Polhemus (JTPC, NCTN, USNM, MBBJ, NHMW).

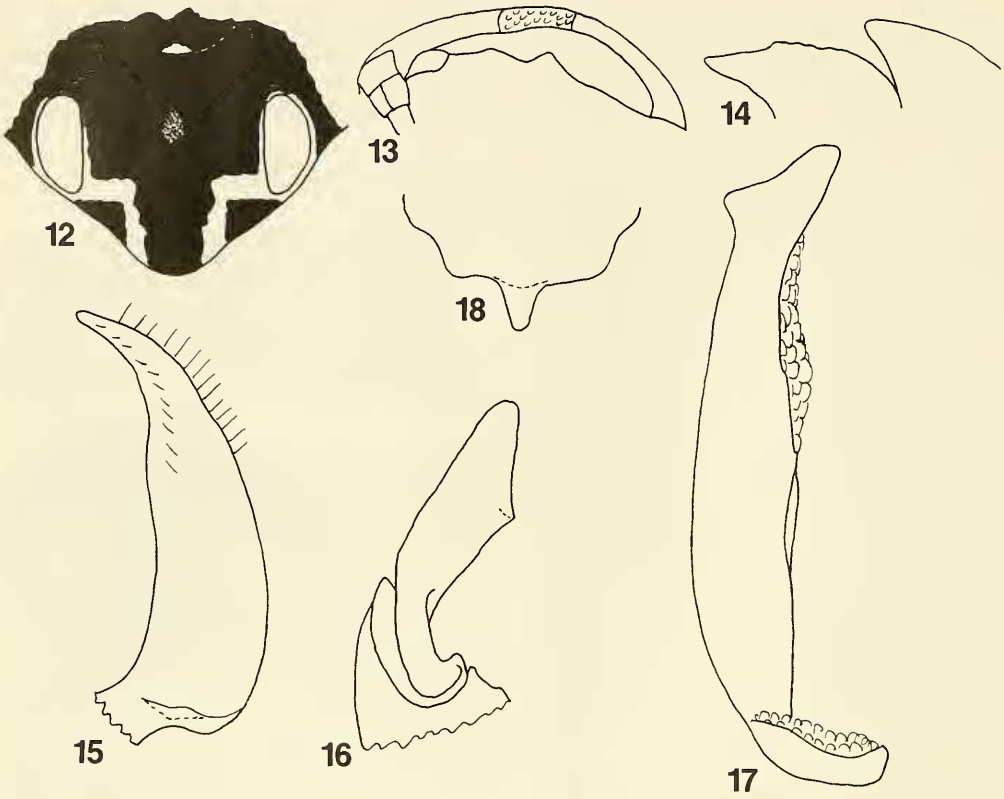
Discussion. – The males at hand match in every detail the exhaustive description given by Esaki & China (1928). The male aedeagus and parameres are shown in figs. 1-3. Because the female of this species was not previously known, sternite VII is figured here (fig. 4). No definite locality was previously established for this species, as the labels on the syntypes simply gave 'Celebes'. The habitat of *Hydrotrephes bouvieri* is unusual for the genus, as it was collected in a lake rather than a stream. The habitat of *bouvieri* was in tangled root masses, along the wave undercut edges of isolated emergent clumps of reeds that formed 'pedestals' in shallow water along the lake shore. *Hydrotrephes corporaali* China has been collected in both lakes and streams (Lundblad 1933; Polhemus unpubl.), so it is likely that *H. bouvieri* also inhabits streams.

Hydrotrephes celebensis Polhemus sp. n.
(figs. 5-11)

Type material: Holotype, brachypterous male: Indonesia, Celebes, Sulawesi Selatan Prov., Marana River, nr. Camba, 50 km E of Maros, CL 2167, 450 m el., 14 Oct. 1985, J. T. & D. A. Polhemus (USNM). Paratypes, 7 brachypterous adults, 8 macropterous adults, same data as holotype (JTPC, NCTN, USNM, MBBJ).

Size. – Brachypterous form: length 2.40 - 2.42 mm, width across base of cephalonotum 2.02 - 2.08 mm.

Colour. – Brachypterous form: ground color yellowish, heavily marked with brown. Cephalonotum with complex pattern of deep brown markings (fig. 5); pronotum with irregular transverse light band across



Figs. 12-18. *Hydrotrephes kamarora* sp. n. –12, Cephalonotum, anterior view; 13, Pronotal and genal plates; 14, Ventral abdominal carinae II, III; 15, Male ventral paramere; 16, Male dorsal paramere; 17, Aedeagus; 18, Female abdominal sternite VII.

middle. Base of scutellum with a transverse deep brown stripe. Hemelytra, scutellum with strong pattern of deep brown irregular, randomly scattered markings covering about half of dorsum. Venter brown. Legs, antennae yellowish, legs darker basally, rostrum brown.

Structure. – Brachypterous form: cephalonotum shining, convex, set with small alveoli, in dorsal view (of entire insect) broader than long (2.08: 1.26), lateral margins carinate behind eyes. Mesopleural and propleural plates notched (fig. 6). Eye length/width, 0.54/0.29. Interocular distance 0.86. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.18: 0.43.

Scutellum shining, finely rugulose, set with tiny alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in some specimens alveoli very clearly delineated due to underlying structure or pigmentation visible through translucent cuticle; length: width; 1.15: 1.15.

Hemelytra opaque, faintly rugulose, set with alveoli each bearing a slender seta; distal locking tab (pseudomembrane) on right hemelytron of usual form. Hind wings reduced to small membranous strips. Ventral carinae of abdominal segments II, III as in fig. 7.

All femora with pectinate bristles beneath, longer basally. Claws of each leg about half as long as distal tarsal segment. Male genital segments modified, twisted strongly to the left; aedeagus and parameres as shown in figs. 8-10. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 11.

Macropterous form: similar in size, color and structure to brachypterous form, except for presence of claval suture and well developed hind wings.

Discussion. – *Hydrotrephes celebensis* sp. n. is so far known from a single population. The body size of both sexes and wing morphs is unusually uniform. The pattern of dark markings on the cephalonotum, and male genitalia are diagnostic.

Etymology. – The name *celebensis* refers to the island of origin.

Hydrotrephes kamarora Polhemus sp. n.
(figs. 12-18)

Type material: Holotype, brachypterous male: Indonesia, Celebes, Sulawesi Tengah Prov., stream 10 km SE of Kamarora, Lore Lindu National Park, CL 2156, 950 m el., 8 Oct. 1985, J. T. & D. A. Polhemus (USNM). Paratypes (nymphs not paratypes), Indonesia, Celebes: 4 brachypterous adults, 6 macropterous adults, 8 nymphs, same data as holotype (JTPC, NCTN, USNM); 2 macropterous males, 1 macropterous female, Sulawesi Tengah Prov., stream 9 km E of Taweli, CL 2160, 150 m el., 10 Oct. 1985, J. T. & D. A. Polhemus; 1 brachypterous male, 2 brachypterous females, 1 nymph, Sulawesi Utara Prov., forest stream S of Lake Mala, CL 2118, 1200 m el., 11 Sept. 1985, J. T. & D. A. Polhemus (JTPC).

Size. – Brachypterous form: length 2.88 - 3.42 mm, width across base of cephalonotum 1.94 - 2.38 mm.

Colour. – Brachypterous form: ground color yellowish, heavily marked with brown. Cephalonotum often completely dark anterior to suture, except along eyes and a small median light streak; lighter colored specimens with a more complex pattern of deep brown markings (fig. 12); pronotum with irregular transverse light band across middle. Scutellum basally dark, lighter posteriorly, with several yellowish areas medially. Hemelytra dark on basal fourth, lighter posteriorly, with scattered lighter regions; some specimens almost completely dark. Venter yellowish brown. Legs, antennae yellowish, rostrum brown.

Structure. – Brachypterous form: cephalonotum shining, convex, set with alveoli, in dorsal view (of entire insect) broader than long (2.34 : 1.44), lateral margins carinate behind eyes. Mesopleural and propleural plates shallowly notched (fig. 13). Eye length/width, 0.58/0.29. Interocular distance 1.19. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.22 : 0.54.

Scutellum shining, not rugulose, set with tiny alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in some specimens alveoli very clearly delineated due to underlying structure or pigmentation visible through translucent cuticle; length: width, 1.48: 1.33.

Hemelytra opaque, shining, set with alveoli each bearing a slender seta; distal locking tab (pseudomembrane) on right hemelytron of usual form. Hind wings reduced to small membranous strips. Ventral carinae of abdominal segments II, III as in fig. 14.

All femora with pectinate bristles beneath, longer basally, densest on anterior femora, sparsest on posterior femora. Claws of each leg about one–third as long as distal tarsal segment. Male genital segments modified, twisted strongly to the left; aedeagus and parameres as shown in figs. 15-17. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 18.

Macropterous form: similar in size, color and structure to brachypterous form, except for presence of claval suture and well developed hind wings.

Discussion. – *Hydrotrephes kamarora* sp. n. is so far known from three populations. The body size of both sexes and wing morphs is quite uniform within each population, but varies considerably between populations. Elevation does not seem to be correlated with size, as the largest specimens are from the type locality at 950 m, the smallest from near Lake Mala at 1200 m, and the intermediates from east of Taweli at 150 m. In all specimens the scutellum is shining and not rugulose. The pattern of dark markings on the cephalonotum, and male genitalia are diagnostic.

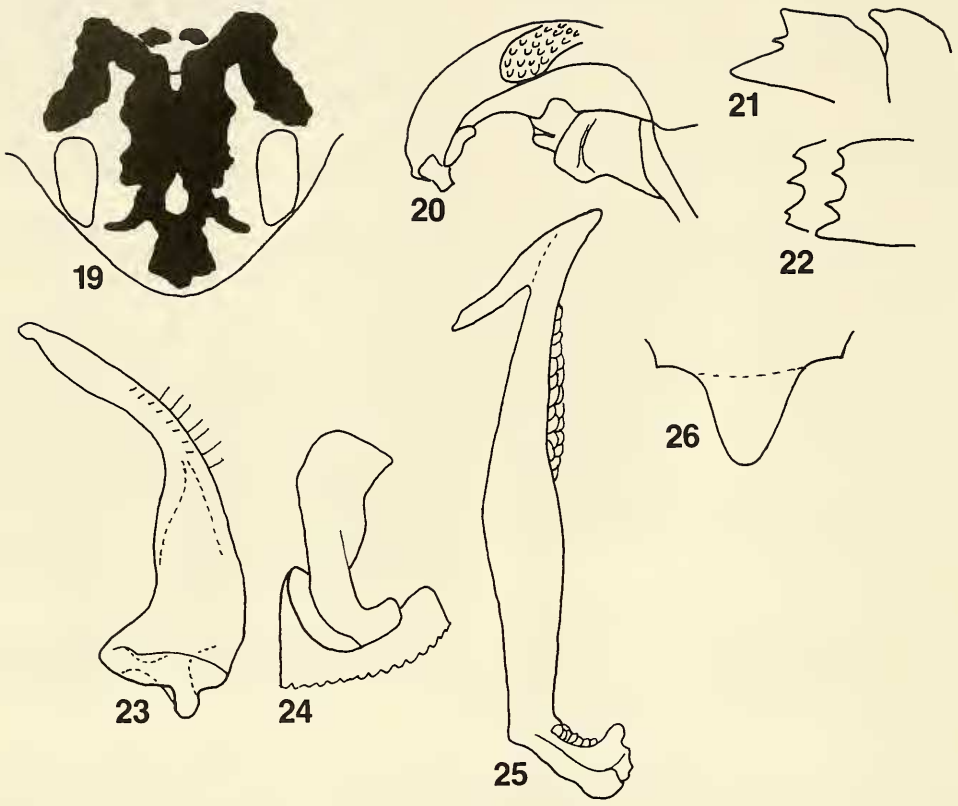
Etymology. – The name *kamarora* is a noun in apposition, referring to the village nearest the type locality.

Hydrotrephes marana Polhemus sp. n.
(figs. 19-26)

Type material: Holotype, brachypterous male: Indonesia, Celebes, Sulawesi Selatan Prov., Sungai Pattanuang at Biseang Labboro Recreation Area, 7 km SW of Bantimuring, CL 2165, 0-100 m el., 13 Oct. 1985, J. T. & D. A. Polhemus (USNM). Paratypes (nymphs not paratypes), Indonesia, Celebes: 7 brachypterous males, 1 brachypterous female, 9 nymphs, same data as holotype (JTPC, NCTN); 2 brachypterous males, 1 brachypterous female, Sulawesi Selatan Prov., Marana River nr. Laiya, CL 2167, 0-100 m el., 14 Oct. 1985, J. T. & D. A. Polhemus (JTPC).

Size. – Brachypterous form: length 2.99 - 3.09 mm, width across base of cephalonotum 2.09 - 2.16 mm.

Colour. – Brachypterous form: ground color yellowish brown to fuscous, moderately marked with brown. Cephalonotum with complex pattern of deep brown markings (fig. 19); pronotum largely yellowish brown, with rather regularly spaced maculations. Base of scutellum with a broad transverse brown stripe. Hemelytra, scutellum with numerous small deep



Figs. 19-26. *Hydrotrephes marana* sp. n. –19, Cephalonotum, anterior view; 20, Pronotal and genal plates, meso- and proepisterna; 21, Ventral abdominal carinae II, III, CL 2167; 22, Ventral abdominal carina III, CL 2165; right, male; left, female; 23, Male ventral paramere; 24, Male dorsal paramere; 25, Aedeagus; 26, Female abdominal sternite VII.

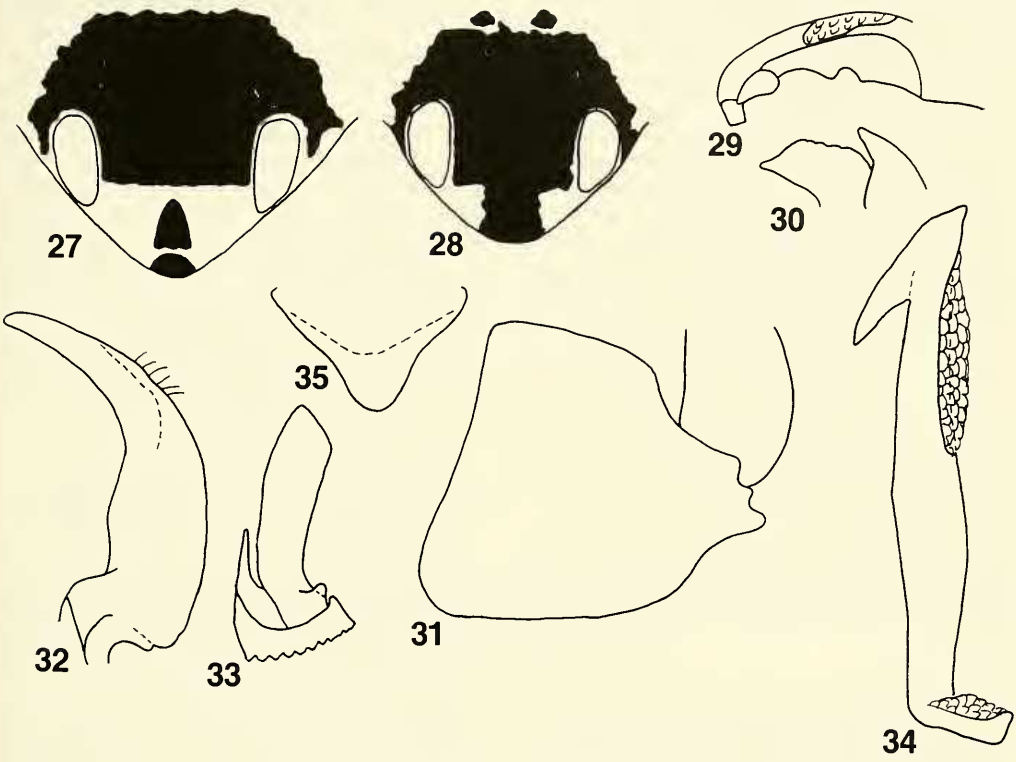
brown irregular, randomly scattered markings, not dense, often anastomosing. Venter brown. Legs, antennae yellowish, rostrum yellowish to brown.

Structure. – Brachypterous form: cephalonotum shining, convex, densely set with small alveoli, in dorsal view (of entire insect) broader than long (2.12 : 1.37), lateral margins carinate behind eyes. Mesopleural and propleural plates deeply notched (fig. 20). Eye length/width, 0.58/0.29. Interocular distance 1.01. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.25 : 0.54.

Scutellum faintly shining, finely rugulose, set with tiny alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in some specimens alveoli very clearly delineated due to underlying structure or pigmentation visible through translucent cuticle; length: width, 1.30: 1.33.

Hemelytra opaque, faintly shining, finely rugulose, set with alveoli each bearing a slender seta; distal locking tab (pseudomembrane) on right hemelytron of usual form. Hind wings reduced to small membranous strips. Ventral carinae of abdominal segments II, III as in figs. 21-22.

Fore and middle femora with pectinate bristles be-



Figs. 27-35. *Hydrotrephes nieseri* sp. n. – 27, Cephalonotum, anterior view, typical variety; 28, Cephalonotum, anterior view, variety *minutus*; 29, Pronotal and genal plates; 30, Ventral abdominal carinae II, III; 31, Male abdominal segment IX, ventral view; 32, Male ventral paramere; 33, Male dorsal paramere; 34, Aedeagus; 35, Female abdominal sternite VII.

neath, longer basally; hind femora mostly bare. Claws of each leg about one–third to half (on posterior) as long as distal tarsal segment. Male genital segments modified, twisted strongly to the left; aedeagus and parameres as shown in figs. 23-25. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 26.

Macropterous form: unknown.

Discussion. – *H. marana* is so far known only from a limited area of Sulawesi Selatan Province. The pattern of dark markings on the cephalonotum, and male genitalia are diagnostic.

Etymology. – The name *marana* is a noun in apposition, referring to the river where part of the type series was collected.

Hydrotrephes nieseri Polhemus sp. n.
(figs. 27-35)

Type material. – Holotype, brachypterous male: Indonesia, Celebes, Sulawesi Utara Prov., tributary to Tumpah River, 0° 35' N, 123° 54' E, 62 km SW of Kotamobagu, CL 2101, ~235 m el. 4 Sept. 1985, J. T.

& D. A. Polhemus (USNM). Paratypes (all collected by J. T. & D. A. Polhemus; nymphs not paratypes), Indonesia, Celebes, Sulawesi Utara Prov.: 144 brachypterous adults, 14 macropterous adults, 17 nymphs, same data as holotype (JTPC, NCTN, AMNH, USNM, MBBJ, NHMW); 54 brachypterous adults, 4 macropterous adults, 15 nymphs, Tumpah River, 0° 35' N, 123° 54' E, 60 km SW of Kotamobagu, CL 2100, 211 m el., 3 Sept. 1985; 2 macropterous females, stream, trib. of Sungai Ongaak Mongondow, 4 km S of Inobonto, CL 2106, 6 Sept. 1985; 24 brachypterous adults, 13 macropterous adults, 2 nymphs, upper Sungai Metelanga and tributary, 10 km S of Dolodua, CL 2108, 7 Sept. 1985; 6 brachypterous males, 2 brachypterous females, warm stream, 8 km S of Dolodua on Malibagu rd., CL 2110, 7 Sept. 1985; 27 brachypterous adults, 1 macropterous female, 3 nymphs, Sungai Metelanga, 5 km S of Dolodua, CL 2111, 7 Sept. 1985; 13 brachypterous adults, 1 nymph, cave spring and stream at Komangaan, NW of Kotamobagu, CL 2120, 14 Sept. 1985; 4 brachypterous males, 2 brachypterous females, 1 macropterous female, Pononontuna River at Tapakulintang, 200 m el., CL 2121, 15 Sept. 1985; 14 brachypterous adults, 2 macropterous females, Tondano river tributary, S of Airmididi, CL 2127, 20 Sept. 1985; 1 macropterous male, stream W of Danowudu, E of Manado, CL 2129, 20 Sept. 1985 (JTPC).

Size. – Brachypterous form: length 2.38 - 2.95 mm, width across base of cephalonotum 1.66 - 2.02 mm.

Colour. - Brachypterous form: ground color yellowish brown to fuscous, extensively marked with brown. Cephalonotum with complex pattern of deep brown markings (fig. 27, 28); pronotum largely yellowish brown, broadly embrowned anteriorly along suture, narrowly dark posteriorly, with a few median maculations in a broad sordid yellowish transverse band. Base of scutellum with a broad transverse brown stripe. Hemelytra, scutellum with numerous large brown irregular, randomly scattered markings, not well defined, often anastomosing, more numerous basally. Venter brown. Legs, antennae yellowish, rostrum brown.

Structure. – Brachypterous form: cephalonotum shining, convex, densely set with small alveoli, in dorsal view (of entire insect) broader than long (2.02 : 1.08), lateral margins carinate behind eyes. Mesopleural and propleural plates deeply notched (fig. 29). Eye length/width, 0.50/0.27. Interocular distance 0.97. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.22 : 0.43.

Scutellum faintly shining, finely rugulose, set with tiny alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in some specimens alveoli very clearly delineated due to underlying structure or pigmentation visible through translucent cuticle; length: width, 1.30 : 1.22.

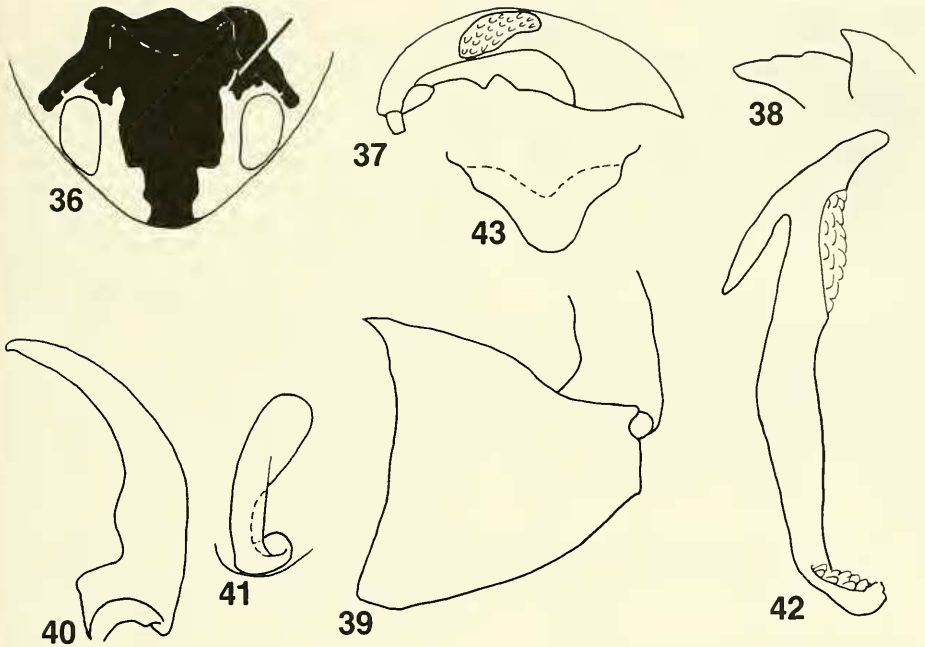
Hemelytra opaque, faintly shining, finely rugulose, set with alveoli each bearing a slender seta; distal locking tab (pseudomembrane) on right hemelytron of usual form. Hind wings reduced to small membranous strips. Ventral carinae of abdominal segments II, III as in fig. 30.

All femora with pectinate bristles beneath, longer basally; on hind femora sparse, shorter. Claws of each leg about one–third as long as distal tarsal segment. Male genital segments modified, twisted strongly to the left; ventral view of segment IX shown in fig. 31; aedeagus and parameres as shown in figs. 32-34. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 35.

Macropterous form: similar in size and structure to brachypterous form, except for presence of claval suture and well developed hind wings, and color usually darker.

Discussion. – *Hydrotrephes nieseri* sp. n. has two distinct varieties, easily separable in most samples on the basis of size and coloration of the frons, that were initially considered to be separate species. The male and female terminalia and all other characters are the same, however, so that these forms can be considered only as varieties, not distinct species-group taxa. The larger specimens with a distinctly separated dark spot on the lower frons (fig. 27) are the typical variety, and the smaller forms with the frons completely dark or with a continuous dark vertical marking on the frons (fig. 28) are given the varietal name *Hydrotrephes nieseri* var. *minutus*. In a sample from CL 2108 these two varieties intergrade and exhibit the complete range of coloration and size, but in most populations the two varieties are easily separable.

H. nieseri may be separated from its congenors by the male genitalia (e. g. posterior margin of abdominal segment IX straight, details of the parameres, shape of the 'bird head' of the aedeagus), and from most species by the shape of female sternite VII. The latter, however, is similar in females of *H. taweli*, which also have a similar body coloration: females of these species may be separated by the coloration of the frons. In *H. nieseri* the frons is almost always completely dark between the eyes, almost to the lower eye level (figs. 27, 28), without light areas mesad of the postero-mesal eye margin, but rarely with a small light region mesad of the antero-mesal eye margin; in *H. taweli* there is almost always a light region next to each inner eye margin (fig. 36), rarely with the mesal dark region reaching the inner eye margins, but always with a light area (fig. 36, arrow) mesad of each postero-mesal eye margin.



Figures 36-43. *Hydrotrephes taweli* sp. n. – 36, Cephalonotum, anterior view; consistently light region, arrow; 37, Pronotal and genal plates; 38. Ventral abdominal carinae II, III; 39. Male abdominal segment IX, ventral view; 40, Male ventral paramere; 41, Male dorsal paramere; 42, Aedeagus; 43, Female abdominal sternite VII.

Etymology. – The name *nieseri* honours Dr. Nico Nieser in recognition of his many contributions to the study of aquatic Heteroptera.

Hydrotrephes taweli Polhemus sp. n.
(figs. 36-43)

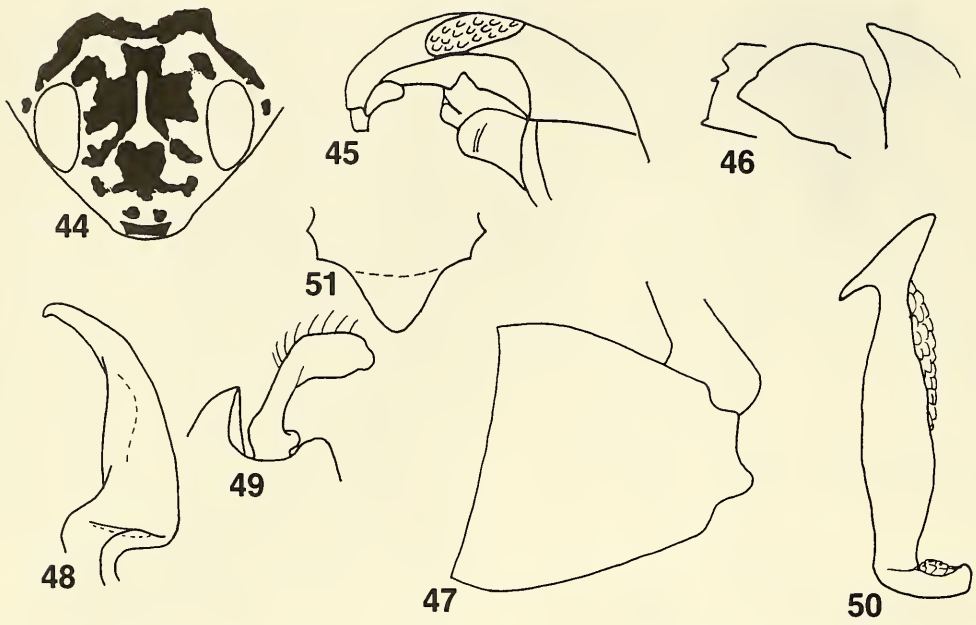
Type material: Holotype, brachypterous male: Indonesia, Celebes, Sulawesi Tengah Prov., stream 9 km E. of Taweli, NE of Palu, CL 2160, 150 m el., 10 Oct. 1985, J. T. & D. A. Polhemus (USNM). Paratypes (nymphs not paratypes), Indonesia, Celebes: 78 brachypterous adults, 75 macropterous adults,10 nymphs, same data as holotype (JTPC, NCTN, AMNH, USNM, MBBJ, NHMW);18 brachypterous adults, 1 macropterous male, Sulawesi Utara Prov., Tondano River tributary, S of Airmididi, CL 2127, 20 Sept. 1985, J. T. & D. A. Polhemus (JTPC); 5 brachypterous males, 3 brachypterous females, 38 macropterous males, 35 macropterous females, 24 nymphs, Sulawesi Utara Prov., Gunung Klabat, Sg. Giriam, N9452, 23 June 1994, Nico Nieser (JTPC, NCTN).

Size. – Brachypterous form: length 2.52 - 2.74 mm, width across base of cephalonotum 1.84 - 1.91 mm.

Colour. – Brachypterous form: ground color yellowish brown, heavily marked with brown. Cephalonotum with complex pattern of deep brown markings (fig. 36), variable, but always with a light area (arrow) mesad of each postero-mesal eye margin; pronotum with broad irregular transverse light band across middle. Scutellum with a basal transverse brown stripe; basal and medial markings often coalescing to form a large irregular triangle extending posteriorly beyond middle, plus additional dark markings. Hemelytra extensively marked with large brown irregular markings, denser basally, often anastomosing, covering more than half of hemelytral area. Venter brown. Legs, antennae yellowish, rostrum brown.

Structure. – Brachypterous form: cephalonotum shining, convex, densely set with small alveoli, in dorsal view (of entire insect) broader than long (1.84 : 1.15), lateral margins carinate behind eyes. Mesopleural and propleural plates deeply notched (fig. 37). Eye length/width, 0.50/0.25. Interocular distance 0.83. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.14 : 0.47.

Scutellum shining, finely rugulose, set with tiny



Figs. 44-51. *Hydrotrephes variegatus* sp. n. – 44, Cephalonotum, anterior view; 45, Pronotal and genal plates; 46, Ventral abdominal carinae II, III; male right; III, female, left; 47, Male abdominal segment IX, ventral view; 48, Male ventral paramere; 49, Male dorsal paramere; 50, Aedeagus; 51, Female abdominal sternite VII.

alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in some specimens alveoli very clearly delineated due to underlying structure or pigmentation visible through translucent cuticle; length: width, 1.01: 0.97.

Hemelytra opaque, faintly shining, finely rugulose, set with alveoli each bearing a slender seta; distal locking tab (pseudomembrane) on right hemelytron of usual form. Hind wings reduced to small membranous strips. Ventral carinae of abdominal segments II, III as in fig. 38.

Fore and middle femora with pectinate bristles beneath, longer basally; on hind femora only on basal half. Claws of each leg about one–half to one–third (on posterior) as long as distal tarsal segment. Male genital segments modified, twisted strongly to the left; ventral view of segment IX shown in fig. 39; aedeagus and parameres as shown in figs. 40-42. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 43.

Macropterous form: similar in size, color and structure to brachypterous form, except for presence of claval suture and well developed hind wings.

Discussion. – *H. taweli* may be separated from its congenors by the morphology of the male and female abdominal terminalia, and the coloration of the frons. It is closest to *H. nieseri*, and the female sternite VII of the two species are similar, but they may be separated by the differently formed dark pattern of the frons; see discussion under *H. nieseri*.

Etymology. – The name *taweli* is a noun in apposition, referring to the village nearest the type locality.

Hydrotrephes variegatus Polhemus sp. n.
(figs. 44-51)

Type material: Holotype, brachypterous male: Indonesia, Celebes, Sulawesi Selatan Prov., Sungai Pattanuang at Biseang Labboro Recreation Area, 7 km SW of Bantimuring, CL 2165, 0-100 m el., 13 Oct. 1985, J. T. & D. A. Polhemus (USNM). Paratypes (nymphs not paratypes), Indonesia, Celebes: 33 brachypterous adults, 20 nymphs, same data as holotype (JTPC, NCTN, AMNH, USNM, MBBJ, NHMW); 1 brachypterous male, 2 brachypterous females, Sulawesi Selatan Prov., Marana River nr. Laiya, CL 2167, 0-100 m el., 14 Oct. 1985, J. T. & D. A. Polhemus (JTPC).

Size. – Brachypterous form: length 2.52 - 2.63 mm, width across base of cephalonotum 1.66 - 1.87 mm.

Colour. – Brachypterous form: ground color yellowish brown to fuscous, moderately marked with brown. Cephalonotum with complex pattern of deep brown markings (fig. 44); pronotum largely yellowish brown, with rather regularly spaced maculations. Base of scutellum with a transverse brown stripe. Hemelytra, scutellum with numerous small deep brown maculations, often oval, rather regularly distributed, often anastomosing. Venter brown. Legs, antennae yellowish, rostrum yellowish to brown.

Structure. – Brachypterous form: cephalonotum shining, convex, densely set with small alveoli, in dorsal view (of entire insect) broader than long (2.12 : 1.37), lateral margins carinate behind eyes. Mesopleural and propleural plates deeply notched (fig. 45). Eye length/width, 0.58/0.29. Interocular distance 1.01. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.25 : 0.54.

Scutellum faintly shining, finely rugulose, set with tiny alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in some specimens alveoli very clearly delineated due to underlying structure or pigmentation visible through translucent cuticle; length: width, 1.30: 1.33.

Hemelytra opaque, faintly shining, finely rugulose, set with alveoli each bearing a slender seta; distal locking tab (pseudomembrane) on right hemelytron of usual form. Hind wings reduced to small membranous strips. Ventral carinae of abdominal segments II, III as in fig. 46.

All femora with pectinate bristles beneath, longer basally; hind femora with fewest. Claws of each leg about one–half as long as distal tarsal segment. Male genital segments modified, twisted strongly to the left; ventral view of segment IX shown in fig. 47; aedeagus and parameres as shown in figs. 48-50. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 51.

Macropterous form: unknown.

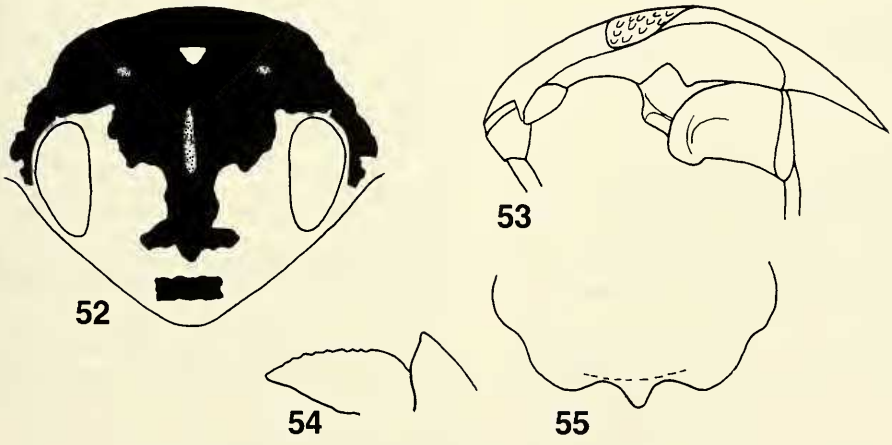
Discussion. – The dorsal dark markings of *H. variegatus* are much more regularly spaced than in other species from Sulawesi, and are often absent from the hemelytra near the base of the scutellum. The pattern of dark markings on the cephalonotum, and male genitalia are diagnostic.

Etymology. – The name *variegatus* refers to the dorsal color pattern of this insect.

Hydrotrephes viriosus Polhemus sp. n.
(figs. 52-55)

Type material: Holotype, macropterous female: Indonesia, Celebes, Sulawesi Tengah Prov., stream 10 km SE of Kamarora, Lore Lindu National Park, CL 2156, 950 m el., 8 Oct. 1985, J. T. & D. A. Polhemus (JTPC; to be placed in the USNM when more material is available).

Figs. 52-55. *Hydrotrephes viriosus* sp. n. – 52, Cephalonotum, anterior view; 53, Pronotal and genal plates; 54, Ventral abdominal carinae II, III; 55, Female abdominal sternite VII.



Size. – Macropterous female: length 3.09 mm, width across base of cephalonotum 2.82 mm.

Colour. – Macropterous female: ground color yellowish brown to fuscous, heavily marked with brown. Cephalonotum with complex pattern of deep brown markings (fig. 52); pronotum largely fuscous, with rather regularly spaced maculations covering all but a few small irregular yellowish areas near suture. Scutellum with a broad basal transverse brown stripe; heavily marked with deep brown anastomosed markings, similar to those on pronotum. Hemelytra with numerous small brown circular markings; almost all of these encompass one alveolus, and most alveoli are pigmented, but the markings rarely anastomose. Venter brown. Legs, antennae yellowish, rostrum yellowish to brown.

Structure. – Macropterous form: cephalonotum shining, convex, densely set with small alveoli, in dorsal view (of entire insect) broader than long (2.82: 1.44), lateral margins carinate behind eyes. Mesopleural and propleural plates deeply notched (fig. 53). Eye length/width, 0.72/0.47. Interocular distance 1.22. Rostral segments 1, 2 extremely short; lengths of rostral segments 3: 4; 0.29: 0.58.

Scutellum shining, not rugulose, set with tiny alveoli, each with one slender setae, each surrounded by a roughly circular transparent region; in some specimens alveoli very clearly delineated due to underlying structure or pigmentation visible through translucent cuticle; length: width, 1.73: 1.73.

Hemelytra opaque, faintly shining, finely rugulose, set with alveoli each bearing a slender seta; distal locking tab (pseudomembrane) on right hemelytron of usual form. Hind wings well developed, reaching tips of hemelytra. Ventral carinae of abdominal segments II, III as in fig. 54.

Fore and middle femora with pectinate bristles beneath, longer basally; hind femora mostly bare. Claws of each leg about one–third as long as distal tarsal segment. Female abdominal segments symmetrical, subgenital plate (sternite VII) as shown in fig. 55.

Brachypterous form: unknown.

Discussion. – It is with some reservations that a single female is proposed as a new species, however I am unable to place this specimen in any of the other species before me. It is almost twice as large as *H. celebensis*, which seems to be its closest congener. The female sternite VII is different than any other, and while the shape is superficially similar to *H. celebensis*, the internal phragma is in a different location; the mesopleural and propleural plates have a slightly different shape; and the pattern of dark markings on the cephalonotum and the hemelytra do not match any other species.

The single specimen is macropterous, suggesting that a more robust population exists somewhere in the vicinity, and the specimen is a 'stray.'

Etymology. – The name *viriosus*, L., robust, strong, refers to the appearance of this insect.

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